APPLICATION PERFORMANCE IMPROVEMENTS IN RADIO NETWORKS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This patent application is a continuation of US Patent Application No.: 13/228,544, filed on Sep. 9, 2011, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] This invention relates generally to wireless networks and, more specifically, relates to techniques for improving application performance between a radio network and a wireless node.

BACKGROUND

[0003] This section is intended to provide a background or context to the invention disclosed below. The description herein may include concepts that could be pursued, but are not necessarily ones that have been previously conceived, implemented or described. Therefore, unless otherwise explicitly indicated herein, what is described in this section is not prior art to the description in this application and is not admitted to be prior art by inclusion in this section.

[0004] Radio networks make radio resource management (RRM) decisions based on radio link conditions, load, buffer size, and the like. Handover decisions are made based on radio link conditions, load, operator policies, and additional data. Scheduling decisions are made based on radio link conditions, buffer size and various other radio parameters.

[0005] However, radio networks do not take into account real time application feedback in RRM decision making, handover decisions, or scheduling decisions. Therefore, if a user using a particular application experiences degradation in performance, the radio network may not be able to return performance of the application to a suitable level or to increase performance of the application.

[0006] A technique called deep packet inspection (DPI) is being used to examine interne protocol (IP) packets in a network such as a wireless access network. This technique is called "deep" packet inspection because the data portion of an IP packet can be examined in addition to examination of multiple headers in the IP packet.

[0007] Radio networks support prepaid and post-paid billing based on volume, time, application usage, and other information. DPI techniques can be used to identify application type for billing purposes. However, there is no current technique for using DPI to evaluate application performance and using real time application performance to trigger billing optimization. Nonetheless, DPI may be used for other scenarios, as described below.

[0008] The third generation partnership project (3GPP) is defining offloading solutions that would enable offloading of Internet protocol (IP) flows based on following criteria:

[0009] 1) Local IP access (LIPA);

[0010] 2) Selective IP traffic offload (SIPTO); and

[0011] 3) Traffic offload functions.

[0012] These offload solutions can either use APN (access point name) or DPI (deep packet inspection) or ACL (access control list) rules. However, existing solutions do not take into account real time application feedback in IP offload decision making.

SUMMARY

[0013] The embodiments set forth in this section are exemplary.

[0014] In an exemplary embodiment, a method is disclosed that includes sending a request to a user indicating options to modify a quality of experience for one or more application flows between a radio network and a mobile node used by the user. The request indicates the user should select one of the following: declining an option to upgrade an existing service to a new service able to support the one or more application flows with a higher quality of experience than supported by the existing service; or accepting an option to upgrade the existing service to the new service able to support the one or more application flows with a higher quality of experience than supported by the existing service. The method also includes, in response to receiving an indication the user selected the option to upgrade the existing service, performing one or more actions to upgrade the existing service to the new service.

[0015] In a further exemplary embodiment, a computer program product is disclosed that includes a computer-readable memory bearing computer program code embodied therein for use with a computer. The computer program code comprises code for sending a request to a user indicating options to modify a quality of experience for one or more application flows between a radio network and a mobile node used by the user. The request indicates the user should select one of the following: declining an option to upgrade an existing service to a new service able to support the one or more application flows with a higher quality of experience than supported by the existing service; or accepting an option to upgrade the existing service to the new service able to support the one or more application flows with a higher quality of experience than supported by the existing service. The computer program code also comprises code for, in response to receiving an indication the user selected the option to upgrade the existing service, performing one or more actions to upgrade the existing service to the new service.

[0016] In an additional exemplary embodiment, an apparatus includes one or more processors and one or more memories including computer program code. The one or more memories and the computer program code configured to, with the one or more processors, cause the apparatus to perform at least the following: sending a request to a user indicating options to modify a quality of experience for one or more application flows between a radio network and a mobile node used by the user, the request indicating the user should select one of the following: declining an option to upgrade an existing service to a new service able to support the one or more application flows with a higher quality of experience than supported by the existing service; or accepting an option to upgrade the existing service to the new service able to support the one or more application flows with a higher quality of experience than supported by the existing service; in response to receiving an indication the user selected the option to upgrade the existing service, performing one or more actions to upgrade the existing service to the new service.

[0017] In an additional exemplary embodiment, an apparatus includes at least the following: means for sending a request to a user indicating options to modify a quality of experience for one or more application flows between a radio network and a mobile node used by the user, the request indicating the user should select one of the following: declining an option to upgrade an existing service to a new service